IC6.4: Optional Job Sheet

Ingredients-based Method for Forecasting Heavy Precipitation

Objective: Examine AWIPS procedures designed to assist in the ingredients-based methodology of forecasting heavy precipitation, as discussed in the IC6 Lesson 4 training module. Specifically, you will be able to find areas of potential symmetric instability (PSI) or conditional symmetric instability (CSI), and determine a lifting mechanism that may release the instabilities.

Data: 24 February 2003 winter weather event across Texas. You will be using D2D for this exercise.

Background: Since CSI is almost always released by frontogenetical forcing, you'll notice in this procedure we are using divergence of $\vec{F_n}$ vectors to assess forcing, saturated geostrophic equivalent potential vorticity to assess instability, and condensation pressure deficit and/or relative humidity to assess moisture. The main difference between CSI and PSI is the use of saturated equivalent potential temperature (CSI) vs. equivalent potential temperature (PSI). The potential in PSI is because the parcel is not saturated. At saturation PSI = CSI.

Instructions:

- Load the 24 February 2003 Winter Weather AWOC case on your WES machine in case review mode, using the FWD localization. Set the D2D clock to 24 February 2003 18 UTC. You will be examining the 24 February 18 UTC NAM 40 model initialization, 6 hr NAM 80 forecast valid at 18 UTC, and observational data. So when answering the questions below, ensure that your answers are based on the **24 February 18 UTC** initialization run.
- With these procedures, always feel free to modify and save them as your own. How to visualize D2D data is subjective, and picking colors, products, and overlays that are comfortable to you is what is most important.
- First, assess the potential for lift. Open the procedure "CSI_PSI" and load "Synoptic Forcing". This loads potential vorticity, geostrophic equivalent potential vorticity both saturated and unsaturated at 4 different layers, Divergence of Q vectors at 3 different layers, and tropopause pressure.

Question 1. Where geographically is Q vector convergence strongest?

Question 2. In which layer is Q vector convergence strongest across south-central Texas?

__________mb to __________mb layer

Question 3. Where geographically is potential vorticity at a maximum?

Question 4. In which level or layer is potential vorticity strongest?

_________________mb

Question 5. Which layer is moist EPV_g at a minimum?

__________mb to __________mb layer

- Examine areas where PV anomalies or Q vector convergence is coupled with frontogenesis. Load from the CSI_PSI procedure "Frotogenetic Forcing, Stability". This procedure loads NAM 40 2-D frontogenesis and Divergence of $\vec{F_n}$ at 25-50 mb increments up to 650 mb. It also loads Saturated EPV_g (MPV_g) at 5 different layers.

Question 6. Where and at what level is frontogenesis strongest? If several strong areas and levels of frontogenesis, list them all.

Question 7. Is there potential instability above the strong areas of frontogenesis? If so, which layers are potentially unstable within 50-100 mb above the level of frontogenesis?

Question 8. Using the information from questions 1-4, where geographically are the frontogenetical forcing and synoptic forcing coupled?

- Next step is to see if ‘upright’ convection is a concern. If the atmosphere is unstable to both upright and slantwise convection, the upright will be released first. In your uncluttered pane, load the procedure “Upright Convection”. This loads NAM 40 ThetaE lapse rates at 800-700 mb, 700-600 mb, 600-500 mb, 750-700 mb, and 700-650 layers. Because the volume browser does not have *saturated* ThetaE lapse rates, the procedure contains RH at those same levels. You’ll be looking for RH values greater than 80%. Load each ThetaE lapse rate as an image as you step through them, and shade only negative values.

Question 9. Circle the appropriate choices for 80% RH and negative lapse rates

800-700 mb Instability present over the eastern half of Texas? **YES/NO**
700-600 mb Instability present over the eastern half of Texas? **YES/NO**
600-500 mb Instability present over the eastern half of Texas? **YES/NO**
750-700 mb Instability present over the eastern half of Texas? **YES/NO**
700-650 mb Instability present over the eastern half of Texas? **YES/NO**

Question 10. Where is the inferred potential for upright convection most impressive, and in which layer?

- To visualize in a plan view all the important ingredients to examine, load in a new pane the NAM 40 2-D frontogenesis levels from answer #6, NAM 80 Q-Vector divergence layers from answer #2, NAM 40 MPV_g from answer #7, and NAM 40 RH/ThetaE lapse rate from answer #10. This pane is useful because it isn’t as cluttered with product descriptions. It’s not a bad idea to load MPV_g and ThetaE lapse rate as toggle images, and shade only values less than + 0.25 PV for MPV_g, and values less than 0 K/km for lapse rates. With this pane, you should have a good idea where the strongest synoptic forcing, frontogenetical forcing, coupling between the two, and instability reside at 18 UTC.
- Now load NAM 40 QPF in a new window. Mentally adjust the QPF towards the area where synoptic and mesoscale forcing are most in alignment.

Question 11. Where do you expect the heaviest precip to fall over the next 12 hours (through 06 UTC 25 February)?

An answer key is available for this job sheet. Please see your local AWOC Winter Weather facilitator to obtain a copy.